(i) Require constant pressure on a control to lower the door,

(ii) Reverse direction and open the door to the upmost position if constant pressure on a control is removed prior to operator reaching its lower limit, and

(iii) Permit a portable transmitter, if provided, to only function to cause the operator to open the door.

(2) Shall be provided with a means for connection of an external entrapment protection device as described in §§ 1211.8, 1211.10, 1211.11, and 1211.12.

(c) A mechanical switch or a relay used in an entrapment protection circuit shall withstand 100,000 cycles of operation controlling a load no less severe (voltage, current, power factor, inrush, and the like) than it controls in the operator, and shall function normally upon completion of the test.

(d) If failure of a switch or relay (open or short) described in paragraph (c) of this section results in loss of any entrapment protection required by § 1211.7(a), 1211.7(f), or 1211.8(a), the door operator shall result in one of the following conditions:

(1) The door operator becoming inoperative by the end of the open or close operation, or

(2) The door moving to and staying within 1 foot (305 mm) of the uppermost position.

(e) During the closing cycle, the system providing compliance with § 1211.7(a) and 1211.7(f) shall function regardless of a short or open anywhere in the low-voltage external wiring to the control, external entrapment devices, or any other external component.

§ 1211.7 Inherent entrapment protection requirements.

(a) Except for the first 1 foot (305 mm) of travel as measured over the path of the moving door operating member, both with and without any external entrapment protection device functional, a downward moving residential garage door operator shall initiate reversal of the door within 2 seconds of contact with the obstruction as specified in paragraph (b) of this section. After reversing the door, the door operator shall return the door to and stop at the full upmost position, unless a control is actuated or an inherent entrapment circuit senses an obstruction to stop the door during its upward travel. Compliance with this paragraph shall be tested in accordance with paragraphs (b) through (g) of this section.

(b) For the tests described in paragraph (a) of this section, a solid object is to be placed on the floor of the test installation and at various heights under the edge of the door and located in line with the driving point of the operator. When tested on the floor, the object shall be 1 inch (25.4 mm) high. In the test installation, the bottom edge of the door under the driving force of the operator is to be against the floor when the door is fully closed.

(c) An operator is to be tested for compliance with paragraph (a) of this section for 50 open-and-close cycles of operation while the operator is connected to the type of residential garage door with which it is intended to be used or with the doors specified in paragraph (e) of this section. The force adjustment on the operator is to be at the maximum setting or at the setting that represents the most severe operating condition. Any accessories that could have an effect on the intended operation of entrapment protection functions that are intended for use with the operator, are to be attached and the test is to be repeated for one additional cycle.

(d) The operator is to be adjusted (limit and force) according to instructions provided with the operator. The operator is to be tested for 10 additional obstruction cycles using the solid object described in paragraph (b) of this section at these settings.

(e) If an operator is intended to be used with more than one type of door, one sample of the operator is to be tested on a sectional door with a curved track and one sample is to be tested on a one-piece door with jamb hardware and no track. If the Operator is not intended for use on either or both of these types of doors, a one-piece door with track hardware or a one-piece door with pivot hardware, as appropriate, may be used for the tests. See the marking requirements at § 1211.15 of this subpart.

(f) An operator shall initiate reversal of the door and shall return the door to

and stop the door at the full upmost position, unless a control is actuated or an inherent entrapment protection circuit senses an obstruction to stop the door during its upward travel, if the lower limiting device is not actuated in 30 seconds or less following the initiation of the close cycle. If the door is stopped manually during its descent, the 30 seconds may be measured from the resumption of the close cycle.

(g) To determine whether an operator complies with the requirement in paragraph (f) of this section, an operator is to be subjected to 10 open-and-close cycles of operation while connected to the door or doors specified in paragraphs (c) and (e) of this section. The cycles of operation while connected to the door or doors need not be consecutive; that is, there may be any number of motor cooling-off periods during the test. The means provided to comply with the requirement in paragraph (a) of this section and §1211.8(a) are to be inoperative or defeated during the test. An obstructing object is to be provided so that the door cannot activate a lower limiting device.

§1211.8 External entrapment protection requirements.

(a) An external entrapment protection device provided with or as an accessory to an operator shall consist of either:

(1) A photoeletric sensor that when activated causes an operator closing a door to reverse direction of the door and prevents an operator from closing an open door,

(2) An edge sensor installed on the edge of the door that when activated causes an operator closing a door to reverse direction of the door and prevents an operator from closing an open door, or

(3) Any other device that provides entrapment protection equivalent to paragraphs (a) (1) or (2) of this section.

(b) With respect to the device mentioned in paragraph (a) of this section, a door operator shall monitor for the presence and correct operation of the device, including the wiring to it, at least once during each close cycle. Should the device not be present or a fault condition occur which precludes the sensing of an obstruction, including an open or short circuit in the wiring that connects the external entrapment protection device to the operator and device's supply source, the operator shall function in one of the following conditions:

(1) A closing door shall open and an open door shall not close more than 1 foot (305 mm) below the upmost position, or

(2) The operator shall function as required by §1211.6(b)(1).

(c) An external entrapment protection device as mentioned in paragraph (a) of this section shall comply with the applicable requirements specified in §§1211.10, 1211.11, and 1211.12 of this subpart.

§1211.9 Additional entrapment protection requirements.

(a) A means to manually detach the door operator from the door shall be provided. The means shall be colored red and shall be easily distinguishable from the rest of the operator. It shall be capable of being adjusted to a height of 6 feet (1.8 m) above the garage floor when the operator is installed according to the instructions specified in §1211.13(a)(2) of this subpart. The means shall be constructed so that a hand can firmly grip it and detach the operator by applying a maximum of 50 pounds (223 N) of force to the means with the door obstructed in the down position. The obstructing object, as described in §1211.7(b), is to be located in several different positions. A marking with instructions for detaching the operator shall be provided as required by §1211.14(i).

(b) Actuation of a control that initiates movement of a door shall stop and may reverse the door on the down cycle. On the up cycle, actuation of a control shall stop the door but not reverse it.

(c) An operator shall be constructed so that adjustment of limit, force or other user controls and connection of external entrapment protection devices can be accomplished without exposing normally enclosed live parts or wiring.

§1211.10 Requirements for all entrapment protection devices.

(a) *General requirements.* (1) An external entrapment protection device shall